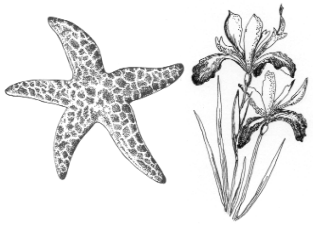
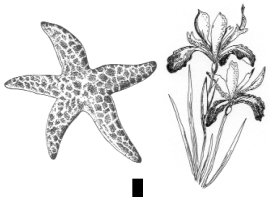
Creating
Coastal Stewardship
through Science



Defining Habitats

Pre-Visit Activities

How Do We Identify the Plants and Animals of Point Reyes National Seashore?



Through a hands-on activity, students will learn observation techniques and become familiar with important characteristics used to identify common wildlife and plant species found at Point Reyes National Seashore. Students will also identify the most common species found in various habitat types by reading a newspaper specific to this unit.

Time required: 30 minutes

Location: classroom

Suggested group size: entire class

Subject(s): science

Concept(s) covered: natural history

Written by: Steve Anastasia and Lynne Dominy, National Park Service

Last updated: 10/09/00

Student Outcomes

At the end of this activity, students will be able to:

- Identify observable species using "key characteristics" that can be used to identify plants and animals in any natural area.
- Understand the complexity and interactions of the habitats found at Point Reyes National Seashore through reading the "Defining Habitats" newspaper.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5b- organisms and the physical environment
- 5c- organisms can be categorized by the functions they serve in an ecosystem
- 5d- different organisms may play similar ecological roles in similar biomes
- 7b- use appropriate tools/technology to perform tests, collect/display data

Pre-Visit Lesson Plan

7th grade 7a- use appropriate tools/technology to perform tests, collect/ display data

8th grade 9a- plan and conduct a scientific investigation to test a hypothesis

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Identify questions that can be answered through scientific investigations; Think critically and logically to make the relationships between evidence and explanations.
- Content Standard C – Populations and ecosystems, diversity and adaptations of organisms

Materials

To be provided by the teacher:

- Pencils/pens
- Blank paper (8½ x 11 inches)
- Flipchart paper/blackboard/butcher paper

To be photocopied from this guide:

- **Pre- and Post- Evaluation** activity sheets (one per student)
- "*Defining Habitats"* newspaper (one per student)

Vocabulary

abiotic factors, amphibian, bird, community, ecosystem, habitat, invertebrate, mammals, niche, plant, population, reptile

Procedures

1. **Pre- and Post-evaluation.**
   Distribute "Pre- and Post-Evaluation" activity sheets. Remind students this is not a graded test, but rather a measure of the success of the lessons. Each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute them in the first post-visit lesson. Students can change their answers based on what they have learned.)

2. **Distribute copies of the *"Defining Habitats"* newspaper to each student.**
   A. Divide the class into eight small groups. Each group will be assigned one of the following habitats: open ocean, estuary, sandy shore, intertidal zone, coastal scrub, riparian corridor, Douglas fir forest, and bishop pine forest. Make sure that students know that some of these habitats are found on multiple pages of the newspaper.
   B. For their specific habitat, students need to list the plants, mammals, reptiles, amphibians, birds, and invertebrates (if present) found in their habitat. Have the students draw simple food chains for any connections identified within the text.

C. Using a large chalkboard or piece of butcher paper, draw the habitat cross-section diagram found on page 6 of the newspaper. Leave plenty of white space on the edges for the open ocean species, intertidal species, and estuary species.
D. Have each student group do a group presentation summarizing the species found in their habitat. List them on the habitat diagram in the location corresponding with their habitat type.

3. **Brainstorming activity.**
   A. What are the important identifying characteristics of each species? (See following Teacher Information sheet, page 50) Have groups of students brainstorm a similar list.
   B. List the potential characteristics for Birds, Plants, Mammals, Amphibians Reptiles, and Invertebrates as a class. A copy of the list is included in the Field Journal.

4. **Wrap up and conclusion.**
   A. As a review, reinforce the importance of the observable behavior and important characteristics in identifying plant and animal species. These characteristics and skills will be used in the field observations at Point Reyes.
   B. Compare your list with the "Identifying Plants and Animals in the Field" Teacher Information sheets on the following pages.
   C. Add any important characteristics that are not currently on the list.
   D. Summarize the continuum of individuals to ecosystems using the Habitat recipe:

      Individual species make up Populations.
      Multiple populations make up Communities.
      Communities + abiotic factors = Habitats.
      Many habitats = Ecosystem.

Extension Activities

1. On school grounds or as a homework assignment at home have each student record data for one or two species that they find in their surrounding environment.
2. Watch a wildlife video without any sound. Try to identify characteristics that will help you identify the different species.
3. Create a picture mural of one or more of the Point Reyes habitats. Have the students draw the species or cut out pictures from various handouts or magazines. Expand this mural out into the open ocean habitats found in the Gulf of the Farallones National Marine Sanctuary. A very nice brochure that summarizes all of the offshore environments is available from the Sanctuary for free (see Resources).

Pre- and Post-Evaluation

Teacher Master

Vocabulary Match-Up

Draw connecting lines between words and their definitions.

Habitat	the ecological role, position, or function of an organism in a community of plants and animals
Biodiversity	place that is natural for the life and growth of an organism
Niche	a system of plants, animals, and nonliving components that interract in a complex relationship
Ecosystem	the number of species in a given habitat and the communities, ecosystems, and landscapes in which they occur

Match Species with Their Habitat

Write one of the following species next to the habitat in which they are most likely to be found: eelgrass, western snowy plover, cow parsnip, coast live oak, and coho salmon

HABITAT:	SPECIES:
Mixed Woodland	***coast live oak***
Coastal Scrub	***cow parsnip***
Riparian	***coho salmon***
Sandy Beach/ Coastal Dune	***western snowy plover***
Estuary	***eelgrass***

National Park System

Which part of the National Park System is closest to where you live?

Point Reyes National Seashore, Muir Woods National Monument, Golden Gate National Recreation Area

True or False?

T/(F) Ice plant is native to California.

T/(F) Fallow deer have been in California for thousands of years.

(T)/F Tule elk are native to California.

Stewardship

What can you do to insure diverse habitats remain healthy in your local area and in Point Reyes National Seashore? List your ideas on the back of this paper.

answers will vary

Pre- and Post-Evaluation

Activity Sheet

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Defining Habitats

of Point Reyes National Seashore

What's Inside

Author's Note

It is important to consider how the influences and impacts of the plants and animals of the past have shaped the present. Landscapes of the past are invoked—salmon-swollen creeks, elk herds on the hills, canyons echoing with the cries of cougars—not because I believe they may possibly reappear, but because conjuring them into our imagination as we wander the hills and the seashore enlivens the present landscape with the shadows of our ancestors.

As you read these articles about Point Reyes and visit its beaches, estuaries, forests, and grasslands, ask yourself "What is the value of this place?"

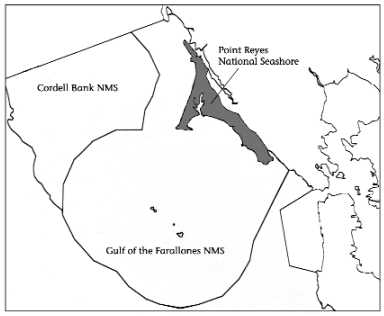
Some things are not easily counted or quantified, yet are no less significant. It is for these reasons that we carefully look after Point Reyes.

Jules Evens

Daisies by the Sea, by Bobbie Belvel

The Pacific Ocean surrounds the Point Reyes Peninsula—waves washing over beaches, breakers crashing into cliffs, spray drenching the sea stacks scattered along the shore. Even the fog that hangs over the hills is salty from the sea. Seen from the Lighthouse or from Limantour Beach, the ocean seems to have a uniform sameness, a vast monotony. Quite the opposite is true. Like forests and fields on the land, the ocean is a patchwork of habitats that reach from the deepest offshore waters to the highest splash zone. And where the ocean meets the land the greatest array of habitat types occur—bays, lagoons, estuaries, tidepools, tidal sloughs, marshes, tide pans, and beaches.

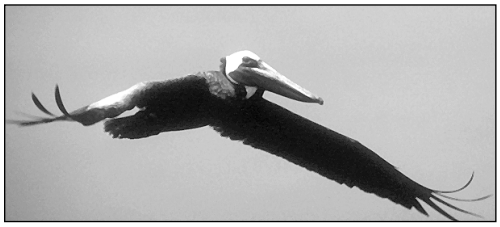
Open Ocean



Imagine that you're a brown pelican flying from the Farallon Islands to Point Reyes National Seashore. As you leave the rocky shore at the Farallones you take a wide arc out to the west for a few miles. There you see a pod of blue whales, the earth's largest mammals, travelling south. They are following the continental shelf, a steep submarine cliff that drops off into onto the abyssal plain, about 35 miles offshore. This change in underwater topography causes a current of cold water from the deep ocean to mix with warmer surface waters, a process known as upwelling. Cold water has more oxygen and therefore "holds" more nutrients than warmer water. Because of this "super oxygenation," many small oceanic organisms—tiny shrimplike creatures called krill and schooling fish—occur in this cold "upwelled" water at the edge of the continental shelf. Pacific gray whales also frequent these waters annually as they travel south to Baja to give birth to their young, then later on their northward journey back to Alaska to feed.

"Discovery consists of looking at the same thing as everyone else and thinking something different." **—Albert Szent-Györgyi**

From Ocean to Estuary

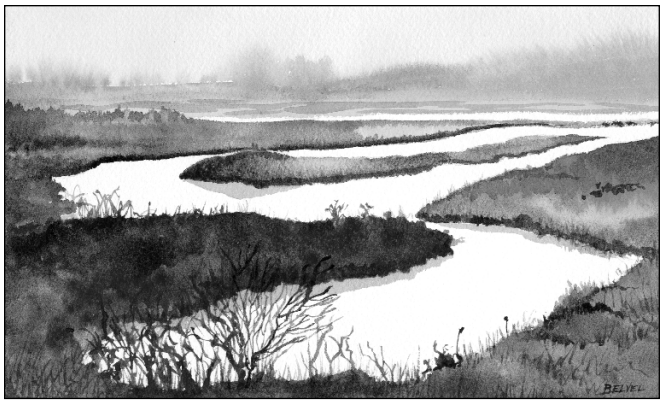


Pelican in flight, Rich Stallcup

Being a pelican, you dive into the cold water in the wake of the whales and snack on a few anchovies before taking off again and flying toward shore. It's a long flap in, across miles of boundless ocean. On the way, you occasionally see other creatures—a blue shark cruising just beneath the water's surface, a white shark eating a harbor seal, some common murres diving for sardines. Some large moon jellies float by, and then you even see a huge turtle, a leatherback, munching on one of the jellyfish!

You know you're closer to shore when you notice more birds like surf scoters and cormorants; there seem to be more marine mammals in the water too—especially harbor seals and California sea lions. These animals congregate in these nearshore waters because it is shallow and there are plenty of places for them to get out of the water to rest, breed, and bear young. Even an animal as oceanic as a northern elephant seal must find a safe place on the shore, called a "haul out", to sleep, breed, and birth its pups. As you circle the rocks just off the Lighthouse, you notice a family pod of harbor porpoises breaking the surface of the water.

Flying along the shore near Limantour Beach you see a school of topsmelt or surfperch just below the breakers. As you dive into the sea to catch some more fish, some other pelicans join you. When you scoop some smelt in your bill, a few manage to wiggle out. An annoying seagull—a dark one with a red bill, called a Heermann's gull—is there to grab your leftovers. These seagulls are called "pirates" because this is the only way they seem to be able to find food, by stealing from clumsy pelicans. Approaching the shore you fly low, catching the updraft of the breakers, bank, and land at the end of Limantour Spit amidst a flock of a hundred other pelicans. All have bellies full with smelt, resting and roosting with the harbor seals and gulls that also gather here, away from the disturbances of humans and dogs.



Estuary by Bobbie Belvel

Estuaries

The tidal marsh that surrounds the estuary provides a transition from ocean to land. Here, freshwater streams meet the saltwater tides creating one of the most fertile ("productive") habitats on earth. Fast growing salt marsh vegetation—cordgrass, pickleweed, and salt grass—provides habitat for its own decomposers (bacteria and amphipods). The estuaries act as the doorways for oceanic fish, such as coho salmon and steelhead trout, to travel into freshwater streams to spawn. They also provide prime habitat for ducks—such as the mallard, green-winged teal, and northern shoveler—to feed. Osprey frequent estuaries to hunt fish, as do snowy egrets and great blue herons.

Coho salmon, NPS Collection

The pelicans can't see beneath the surface, but riding into the estuary on the rising tide are leopard sharks and other fish— Pacific herring, rubberlips, and topsmelt—entering the estuary to take refuge in the meadows of eelgrass that sway beneath the water. You can find the eelgrass, washed up on earlier tides and decomposed, along the shore of Limantour. The eelgrass beds harbor other animals too. Animals with strange names—nudibranchs, hyrdroids, sponges, tunicates, skeleton shrimp, "fixed" jellyfish (they are attached to the grass, not free-swimming like we think of jellies), bubble-shell snails, sea hares, periwinkles, sea slugs, tube worms, limpets, grass shrimp, razor clams, and sea cucumbers—live on the blades. In the roots on the bottom (benthos) are animals that live in the mud and siphon microscopic food from the water—clams, feather-duster worms, fat innkeepers, for example. The eelgrass beds are teeming with creatures that live there always, but the grass also provides food for animals who are passing by, like the sea goose called the black brant. Pacific herring, one of the most abundant fishes, and a favorite food of the pelican, come to lay their eggs here. The arrival of the herring is signaled by the flocks of seabirds that come to eat the herring roe. Loons, grebes, scaup, and scoters congregate above the eelgrass pastures, stuffing themselves on the buffet.

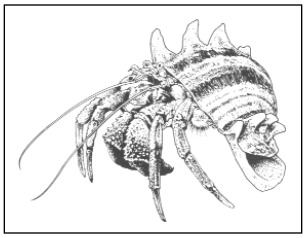
The tide is rising. A surge of cold water floods into the estuary, bringing in nutrients—particles of decayed marine plants and animals, minerals and molecules—that have been brought to the surface by the upwelling waters. The life of the estuary is determined by the tides that wash in and out twice daily. The plants and animals that live in the estuary rely on the tide to bring them nutrients, but they also must deal with the problem of being covered with salty water, or exposed to the dry air. These two contrasting conditions require certain adaptations, and each species of plant or animal has a different ability to withstand the stress of being under water, above water, or both. To deal with the tidal changes, groups of organisms are distributed at different tidal levels, or

Into the Mud Flats

Mud flats, Bruce Farnsworth

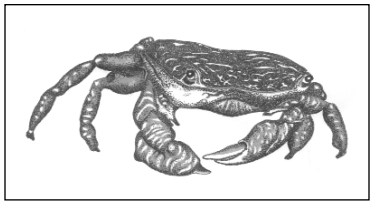
zones, within the estuary, depending on the amount of time they must stay above or below water. We will consider these communities from the deepest channel, which is almost always covered by the ocean water, to the edge of the land that gets soaked by only the highest tides.

In the deepest water of the estuary, amidst the blades of eelgrass are a myriad of small and camouflaged (cryptically colored) organisms that are difficult to see with the naked eye. Dainty little snails (*Nassarius*) are abundant—grazing on small algae that grow on the grass blades. Some of these snail shells are not occupied by the original snail, but have been taken over by hermit crabs that use the shells for their own.

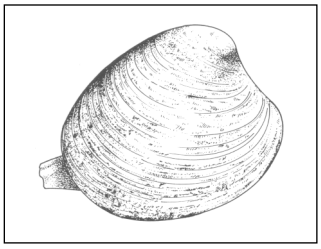


Hermit crab, NPS Collection

Eelgrass can grow in channel bottoms and deep basins within the estuary, but much of the bottom is flat and exposed to the dry air for longer periods of time. These "mudflats" or tidal flats support their own unique community of plants and animals. Because the mud flats have few places for animals to attach, the sea stars and urchins of the rocky shore, or the sponges and moss animals of the eelgrass beds are largely absent. Healthy tidal flats are colonized instead by vast cities of worms, clams, and snails. Most of these mud flat dwellers are burrowers and "deposit feeders." In the "low intertidal" flats or zone next to the eelgrass beds, the areas that get the most tidal flow, live some of the larger clams, most notably the geoduck, pronounced "gooey-duck." The geoduck lives in the gooey-est muck in a deep burrow that can be up to 5 feet deep. Any disturbance at the surface signals the clam to retract its enormous siphon that causes a spout of water to shoot up. Geoducks can live at least 15 years and grow as large as 12 pounds. Another big clam in this lowest zone is the gaper clam; it also has a squirt hole in the mud that may surprise you with a spout as you walk across exposed mud flats. Gapers only get to be about 4 pounds in size. When the tide is in, these clams have their siphons extended to suck food from the water. They have to be careful, however; leopard sharks and bat rays ride in on the tide and try to snip off the siphons with their razor-sharp teeth.



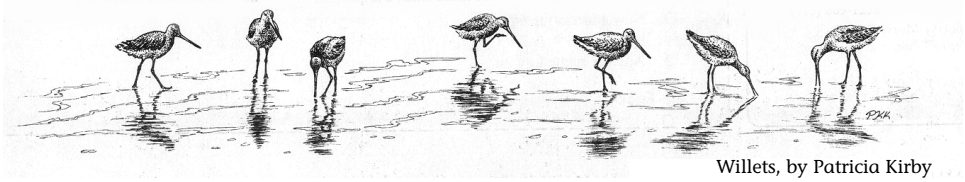
Shore crab, Lisa Halton



Clam, NPS Collection

Another common low intertidal clam is the Washington clam, also called the "money-shell" clam, since the native Californians used the shell for money. If we could see a cross section of the low intertidal flats, we'd see all the clams burrowed beneath the surface and there would also be a U-shaped hole that housed perhaps the most curious of all the mud flat inhabitants—the fat innkeeper worm. The innkeeper is about the size of a fat cigar, and is called an "innkeeper" because of all the guests that share its big burrow. Because the innkeeper is so good at getting food, three other creatures hang out in the burrow waiting to eat the leftovers, or the morsels he drops—like the scavenger gulls that follow the pelicans around. These three guests include a red scale worm, a goby fish, and a pea crab. Flounders and bat rays apparently can extract bottom dwelling animals like the innkeeper, by using their broad, flattened bodies like a plumber's helper and suctioning the prey out!

Higher up, where the mud flat meets the shore and in the tidal sloughs that meander through the tidal marsh, the most obvious animal is the Oregon shore crab, *Hemigrapsus*. Squarish, dull green, and not very large, "Hemi" burrows in myriad holes along the bank. Shore crabs feed mostly at night on diatoms and green algae that grow along the muddy shore, picking at their food with each claw. Mussels live along the upper shore as well, especially in undercut banks. Look for raccoon tracks in the mud along the shore; they seem to come to hunt primarily for crabs and mussels. Snails too are common on the higher mud flats, especially the channeled basket whelk and tall-spired horn snail. The horn snail is most easily found in the marsh pans (small tidepools in the marsh) where it grazes on detritus and diatoms covering the mud. Basket whelks are carnivores, however, and will eat both dead and live meat. The fact that basket whelk migrate down to the eelgrass beds to deposit their egg capsules is another example of that habitat's value as a nursery.



Willets, by Patricia Kirby

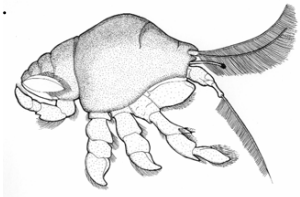
Along the Sandy Shores

The Great Beach, Sue Van Der Wal

Most of the animals that live on the beach bury themselves in the shifting sands, moving up and down the beach as the waves break and the tide turns. One of the most common animals of the lower beach, the mole crab, has to be able to burrow very quickly to move with each incoming wave and avoid being eaten by the sandpipers that are also following the waves in and out. Seaweed and other flotsam gather on the upper beach, washed by only the highest tides and biggest waves, along what is called the wrack line. Sometimes, especially after a strong storm, the wrack line is a tangle of bull kelp and feather boa algae, and if you sift through this smelly detritus, you'll find the other most common inhabitant of the outer beach, the beach hopper.

Unlike the estuary that produces its own food sources—sea lettuce, diatoms, microscopic algae, and eelgrass—little sustenance is produced by the sandy beach. The major source of food in this habitat is either plankton washed ashore by the waves, or the dead seaweed and corpses of fishes, birds, and marine mammals cast ashore by the waves. Look for the egg-shaped shells, or carapaces, of the mole crabs scattered along the beach. You should be able to find them since many are left behind by sanderlings or willets after they've eaten the body of the crab. The shells are ivory colored and about the size of your thumb. The following is a description of their feeding habits:

> When in the sand, the mole crab always stands on end, head end up and facing down the beach toward the surf. Characteristically, the entire body is buried, while the eyes (tiny knobs on long stalks) and the first pair of antennae (which form a short tube for respiration) project above the sand. When a wave starts to recede down the beach, the sand crab uncoils its large second pair of antennae (like small feathers) and projects them in a V against the flowing water to gather minute organisms . . .

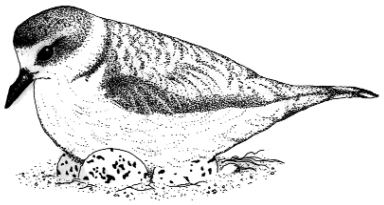


Mole crab, Christie Anastasia

Mole crabs can be in very dense aggregations, concentrated in the wet sand where the waves are breaking. Not only are they constantly being preyed upon by shorebirds, but when a large wave washes in, surfperch try to eat them as well, so they are being hunted on both the inwash and the outwash of the wave.

Another common animal, though rarely seen, is a red worm that burrows in the sand a few feet above the tide. These worms feed by swallowing grains of sand and digesting the detritus that has gathered on the grains, in effect cleaning the beach. Beach hoppers, or amphipods, are about the size of a pea; you can find them under the wrack on the upper beach, but they are most active at night. Although amphipods avoid the waves, they like to stay moist in the wet seaweed. The beach hoppers are decomposers—they eat, or break down, the dead things that wash up on the beach. Other scavengers that occur on the beach include turkey vultures and gulls. Also, judging by the tracks that follow the tide line in the early morning, skunks, foxes, and raccoons visit the beach at night in search of a fresh bird or fish carcass. All these beach janitors are recyclers of the highest order.

Just beyond the grasp of the highest tides, a coastal dune community exists. This dry, sandy habitat is host to many plants such as the American dune grass, sand verbena, saltbush, beach strawberry, dune lupine, and beach morning glory. The dunes provides a safe resting place for many animals, especially during high tide and at night. In the more remote beach areas large flocks of birds—pelicans, gulls, shorebirds—congregate. One bird in particular lives on the beach and relies on it not only for roosting, but also builds its nest in the dunes. The Western snowy plover, a small, pot-bellied shorebird, nests here at Point Reyes and raises its chicks along remote stretches of beach. They probably eat the beach hoppers as well as other small invertebrates that venture out onto the sand. Because the snowy plover is endangered, the Seashore has set aside certain beaches for its protection and restricted people from walking dogs there. Also, because plovers are being preyed upon by ravens, the biologists have constructed "exclosures", large nets and fences around the nests that keep predators away from the adults and chicks.



Snowy plover, Lisa Halton

Occasionally when walking the beach you'll find jellyfish washed up along the shore. One of the most peculiar looking of these doesn't even look like a jelly. The "by-the-wind sailor," also known as Vellela, looks like a rumpled piece of cellophane with blue or purple dye along its edges. Under certain conditions Vellela will be strewn in lines for miles down the beach. What are these conditions? As the name "by-the-wind sailor" suggests, Vellela is distributed by the wind and appears on our shores usually in spring after the first strong westerly winds of the year, having been blown here from somewhere out in the middle of the Pacific Ocean.

One of the attractions of the beach is the possibility of finding just about anything that has been washed in by the tide. Most common are big "moon jellies," bull kelp, dead seabirds (especially murres, grebes, and scoters), sea lion carcasses, and driftwood. In the driftwood look for goose barnacles that have attached themselves at sea, or the European shipworm which bores through wood with the rasplike teeth on its shell. Other common finds include sand dollars, and the shells of razor clams, olive snails, and shore crabs.

Intertidal Zone

Halfway between land and sea, on the rocky shelf where waves break against rocky outcroppings, is the intertidal zone, a realm inhabited by fabulous creatures that look as if they came from another world. Check a tide table for low tide times, dress to protect yourself from wind, and wear shoes that can get wet and still give good traction. Then tread cautiously. Be careful not to disturb or destroy the creatures that make the intertidal zone their home. Now you can discover the delicate and other-worldly magnificence of the tidepool.

What is the Intertidal Zone?

In the intertidal zone, the ocean rises and retreats twice each day. Its inhabitants are exposed alternatingly to immersion in salt water and exposure to air. The animals that survive in this sometimes wet and sometimes dry habitat are mostly invertebrates. Many of the plants are algaes.

The high intertidal zone is the area closest to the beach, which is covered with water only once or twice a day during high tides. Here, look for ribbed limpets, acorn barnacles, eroded periwinkle, small-shelled snails, black turban snails, rockweed (a type of brown algae), and lined shore crabs.

In the middle intertidal zone, the area that is exposed at least once a day due to tidal fluctuations, you will find California mussels and the olive green aggregated anemones. These animals cover themselves with sand and bits of shell to prevent loss of water from exposure to wind and sun. Look for ocher stars, mossy chitons, goose barnacles, and sea lettuce.

In the low intertidal zone, the area that is exposed only during a very low tide, look for purple sea urchins thriving amid the strong wave action. One may also find the bat star, a sea star which is webbed between its arms. Giant green anemones, up to 17 cm wide and a vivid olive green with brown tentacles, and coralline algae, an encrusting pinkish lavender/red algae, grow in this zone.

Listening to Plants

***"When I discovered a new plant, I sat down beside it for a minute or a day, to make its acquaintance and hear what it had to tell . . ."*—John Muir**

The diverse array of plants at Point Reyes National Seashore can tell us many stories of time and change. The windswept grasslands near Tomales Point tell of tule elk roaming the hills of coastal California. Charred blackened trees and small pine seedlings are reminiscent of the Vision Fire racing down Inverness Ridge burning and reinvigorating everything in its path. The open rangelands tell us stories of placid dairy cattle making their way home through the fog to the milking barn, and of the smiling faces of travelers witnessing spectacular wildflower displays near Chimney Rock. Today, the plants of the Seashore tell the story of competition—competition between the native plants that belong here and the nonnative species that have been introduced.

Rare Sonoma spineflower, NPS Collection

The native plants of Point Reyes National Seashore reflect our past and set the stage for our future. Evolving alongside animals, fungi, and microbes, they form complex ecological webs. Native plants play critical roles as oxygen producers, decomposers, water purifiers, soil developers, and providers of food and habitat for wildlife. Without them, the land we have come to know as Point Reyes would be significantly different.

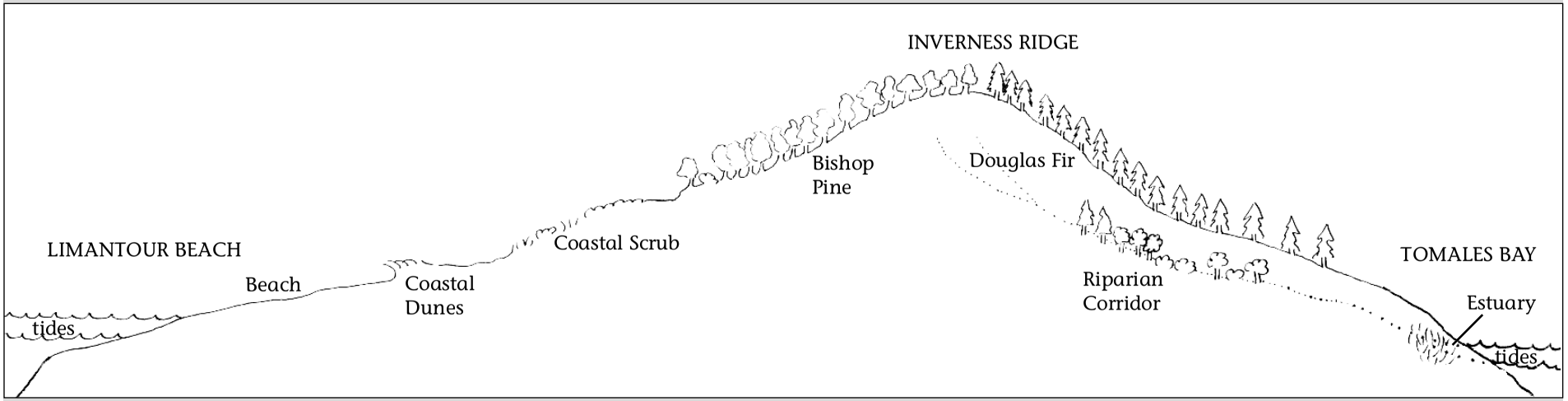
As native systems have been altered in other areas of California, many native plants have been pushed to the brink of extinction. Point Reyes National Seashore serves as a refuge for an astonishing number of these rare plants. Forty-seven of Point Reyes' plant species are considered rare. Hundreds of their populations are scattered throughout the Seashore where habitat has not been subject to extensive development. Offering the last chance to protect them from extinction, these rare plants are actively monitored and managed by park scientists. The rarest of the rare, Sonoma spineflower (*Chorizanthe valida*), occurs naturally in one population in coastal prairie habitat. Prior to 2000, this was the only population known to occur in the world. This year, however, NPS vegetation managers succeeded in establishing a second population in similar habitat in the Seashore.

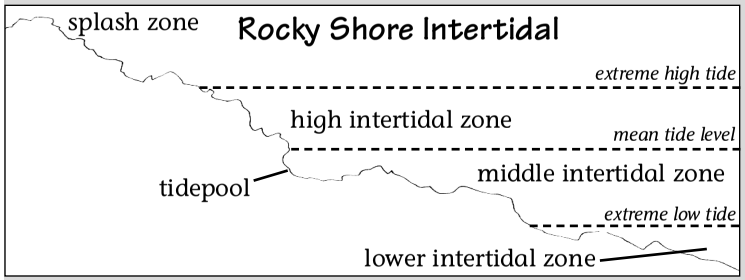
One of the most critical threats to the rare plants and native habitats of Point Reyes National Seashore is the presence of nonnative plant species. Introduced from early settlers, their animals, and landscape plantings, nonnative plants and seeds have taken root at Point Reyes. Invasive nonnative species tend to spread very rapidly and form dense monocultures out-competing native plants for scarce space and resources. Over time, invasive plants can dramatically alter ecosystems that have been in place for thousands of years.

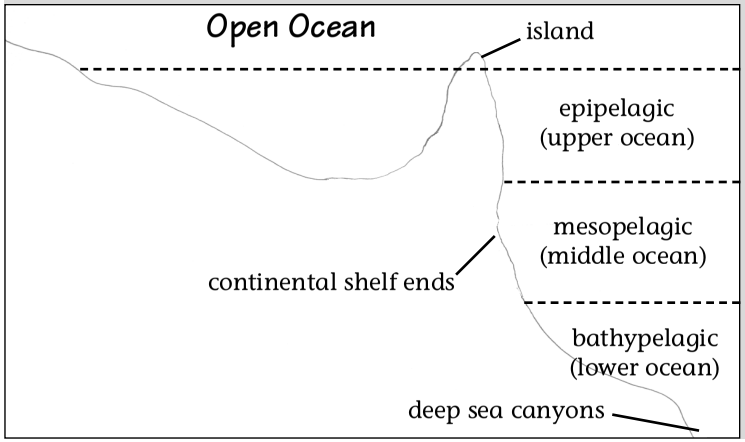
Volunteers removing nonnative Scotch broom, NPS Collection

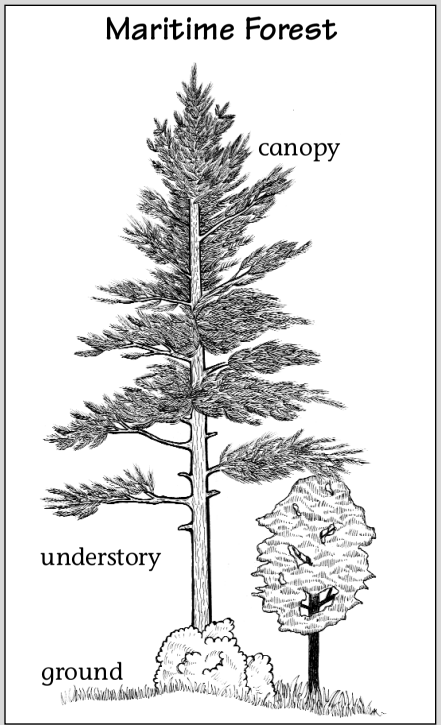
Keeping the stories told by native plants alive in the landscape is a daunting and difficult task. To curb the tide of many of the Seashore's nonnative invasive plants, volunteers are recruited to remove the most threatening species. With a limited amount of money and time, there is no way to stem the tide of all nonnative species nor bring back all the habitat that has been lost or altered. But we can work together to keep Point Reyes' plant communities as healthy and diverse as possible so the stories told by the plants of the Seashore will continue well into the future.

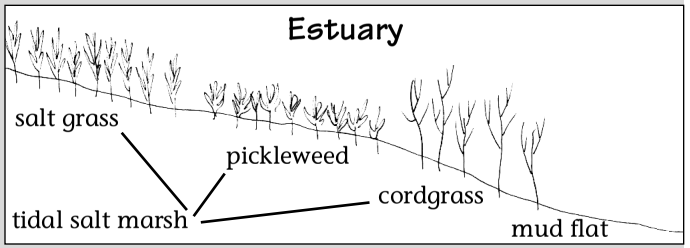
Habitats of Point Reyes National Seashore











Douglas Fir Alliance

The Douglas Fir habitats (and all other plant habitats) are actually a mosaic of plant associations based on soils, sun, water, and historical disturbances. Five associations have been identified at Point Reyes National Seashore for the Douglas Fir:

Douglas Fir - California Bay - Western Sword Fern
Douglas Fir - Coyote Bush
Douglas Fir - Coast Live Oak
Douglas Fir - California Bay - Coffeeberry
Douglas Fir - Tanbark Oak - Coffeeberry

Exploring the Landscapes

Turkey vulture, NPS Collection

Turkey vultures fly high over the land, continually searching, ranging far and wide, from the shoreline to the ridge top. Everything is connected by the passing shadow of this bird.You can recognize its silhouette —long wings with fingerlike flight feathers outstretched, rarely flapping, often rocking from side to side as it flies. All day long it cruises over the landscape, usually flying alone or in small flocks, along the sandy beach, across the coastal scrub and prairie, over the forest of Douglas fir, bishop pine, live oak, and bay laurel.

Mountain Lion, NPS Collection

California poppies, NPS Collection

California quail, NPS Collection

Turkey vultures are scavengers and carrion eaters, which means they devour only dead meat—a seal that has washed up on the beach, a road-killed deer, a cow or elk that has died a natural death out in some pasture. This serves a very important service to the environment. By devouring freshly dead animals, vultures reduce the opportunity for diseases to breed. The digestive juices of the turkey vulture are among the strongest enzymes in nature, capable of breaking down powerful microorganisms, like the infectious bacteria anthrax (*Bacillus anthracis*) that thrives in decaying cattle and sheep and usually results in the slow and agonizing death of any warm-blooded animal that gets infected. The vulture, therefore, is nature's sterilizer, cleaning up the landscape for the health and safety of all.

Vultures, soaring machines that they are, especially like the hot air currents called thermals, that rise off the ground as the day heats up. Therefore, they tend to be in warmer areas (very rare in northerly places like Canada) and most active during the middle of the day. Thermals do not occur over water, so vultures stay over the land; you'll almost never see a vulture venture out over the ocean! When you see a vulture overhead, think about the habitat they are soaring over and the animals that live there; just about any of them is potential vulture food. Do you think a rabbit, or a squirrel, or a quail is concerned when it sees a vulture fly over? If yes, why? If no, why not? Let's think about the vulture's environment, and the species that live there.

Coastal scrub

From a turkey vulture's perspective, the coastal scrub—those large sloping hillsides that reach from the ridge top nearly down to the beach—is an ideal home. The breeze from the ocean provides continual air currents to catch, there are few trees so it's fairly easy to see thing, and the vegetation supports a large variety of animals that are potential food items.

Trees are few in the coastal scrub; only a bishop pine or Douglas fir scattered here and there. The name "scrub" refers to the abundance of bushes that are the dominant plant form in this habitat—coyote bush, poison oak, bush lupine, ceanothus ("blue blossom"), and huckleberry— to name a few. Coyote bush is the most common and is the indicator plant of the coastal scrub habitat. It is an evergreen shrub, three to six feet tall with stiff, bright green foliage and small white flowers. The coyote bush community provides cover for many mammals and birds, including deer mouse, brush rabbit, gray fox, coyote, spotted skunk, black-tailed deer, tule elk, California quail, bobcat, and mountain lion. The fox and rabbit are among the most common of these; if you find fox scat, the fur in it is most likely that of the brush rabbit.

One of the most obvious flowers you'll see is bush (or "sticky") monkey flower (*Diplicus aurantiacus*) with sticky green leaves and salmon-colored flowers that bloom almost year-round. Also long blooming, but bright scarlet in color, is Indian paintbrush (*Castilleja*). Anna's hummingbird is a year-round resident in the coastal scrub, largely because of these two abundant and often available food plants. Other showy spring flowers include the California poppy and Douglas iris.

One of the world's most beautiful reptiles can also be found here in the warmer months, the red-sided garter snake (*Thamnophis sirtalis*). Its diet includes many of the smaller animals that also live in the coastal scrub—tree frogs, banana slugs, salamanders, spiders, earthworms, and even small mice and birds. Of course, the snake may be eaten by any of a variety of predators, too—coyote, northern harrier, raccoon, and striped skunk.

Whenever a nonnative species is introduced into a habitat there is potential for dramatic change to occur. Some nonnatives are aggressive and compete with the native species for habitat and food. Others may introduce foreign parasites and diseases. Studies are being conducted at Point Reyes National Seashore to answer the following questions:

- What are the effects of the bullfrog on the federally endangered California red-legged frog?
- Are fallow deer competing with the native black-tailed deer and the tule elk?

Knowing which species are the greatest threats will help researchers determine how to best protect the native species.

Nonnative fallow deer, NPS Collection

From Streams to Forests

Riparian corridors

Riparian means "streamside," and refers to the thickets of large shrubs and trees that grow only along the banks of creeks and streams. The dominant plants of the riparian thickets in Point Reyes National Seashore are yellow willows and red alders, both deciduous tree species that lose their leaves and bud out in early spring. Riparian plants like to have their roots damp all the time and therefore grow only in the lowest portions of the watershed. Blackberries, stinging nettle, horsetails, and miner's lettuce are common plants found in the riparian understory. The environmental benefits of riparian plants are many. Beneficial bacteria grow on their roots; these bacteria have the ability to take nitrogenous waste out of the groundwater, "fix" it and release it into the water as nitrogen, a basic food source for microorganisms. For this reason, this process is called nitrogen fixing.

Many of the animals that live in the riparian zone—especially fish and amphibians— require cool water to survive. The overhanging willow and alder foliage shades the water and keeps it cool in the warm summer sun. The root system of the vegetation twines out of the streambed, slowing the water and providing hiding places and attachment sites for many invertebrates, animals like opossum shrimp and caddisfly larvae, which are food for young trout and salmon. The leaves of the trees fall into the stream and break down, giving nutrients to the streambed that can be eaten by the small decomposers.

Why do we call the riparian habitats corridors? Watercourses flow from high ground to lower ground, through a variety of habitats. Because they are long and narrow, like hallways, they provide corridors, or runways of movement for animals from the highlands to the lowlands. These corridors are of special importance to migrating birds, but are also critical to amphibians such as California red-legged frogs, tree frogs, banana slugs, newts, and salamanders. Mule deer take shelter from the midday sun in their shade. Great horned owls and northern spotted owls sleep in the shade of the willow tree or nest in a hollow stump of an alder tree.

California red-legged frog, NPS Collection

Banana slug, NPS Collection

Douglas fir forest

If you walk through the fir forest—at Sky Trail, or Bear Valley—on a foggy day, on a day when it's too damp and cold for turkey vultures to fly, you'll notice how moist the ground is; you'll feel the fog drip from the boughs of the trees overhead. Douglas fir trees are very adept at capturing moisture out of the air, and even when it's not raining, it may feel like rain within the forest. Scientists have found that the precipitation beneath fir trees is twice the annual rainfall. At Point Reyes, where the annual rainfall averages about 40 inches a year, the total precipitation in the fir forest may be more than 80 inches! (How tall are you? Compare your height with the annual rainfall and the total precipitation in a fir forest). This ability to capture moisture in the air insures that the ground will be recharged (or rehydrated) by the trees and ultimately provides the foundation for a diverse forest. The Douglas fir forests of Point Reyes may be shared by the California bay and a varied understory of California coffeeberry, California hazel, red elderberry, ceanothus, poison oak, huckleberry, and thimbleberry. The mixed woodland forests surrounding the Douglas firs contain coast live oaks and tan oaks that provide habitat and food for many species including the acorn woodpecker. Two types of deer are commonly seen in these forests although the black-tailed deer is the only native species.

Douglas fir cones, Bruce Farnsworth

The Douglas fir is a grand tree; some individuals within the Seashore rival redwoods in girth and height. Like bishop pines, Douglas fir forests thrive following a fire. The seeds germinate readily, but only those seedlings survive that receive direct sunlight and whose roots come in contact with mineral soil. Therefore, before a new forest can become established, some event must clear the mother forest, provide a bed of mineral soil, and reduce competition from other trees. Fire is the only natural event that provides these conditions.

Bishop pine forest

Overhead, the turkey vulture soars, silently watching the world below. On a pale granite outcrop, silhouetted against the gray skies of summer, a bishop pine (*Pinus muricata*)—trunk awry, limbs askew—stands sentry over the rolling grasslands that stretch toward the dunes of Limantour Beach and the swollen surf beyond. Hidden in the tufted clusters of long needles that splay from the ends of the smaller branches, a Steller's jay sounds a scolding "caw". Molded by the contrary forces of wind, substrate, and available moisture, these contorted conifers lend a twisted grace to the landscape and more than any other species, symbolize the unique and natural beauty that encompasses Point Reyes.

Although once widespread, bishop pines now occur in relict stands, scattered along the humid coastal region of California. Point Reyes hosts one of the most extensive and picturesque groves. Heavily influenced by soil, slope, and microclimate, bishop pines vary in shape and size.

Forests . . .

Bishop pine cones, Bruce Farnsworth

While some trees grow lanky, straight, and tall, many are short and ragged in appearance. One of the most unusual characteristics of this tree is the large, heavy cones located on the main branches and trunk of the tree. The cones are arranged in tight whorls, their scales sealed closed with pitch. On a hot day, one can hear the cones crackle as the dried resins release the scales, freeing the seeds to fall or be eaten by finches or sparrows. Western gray squirrels also feast on the cones, but they will attempt to gnaw out the seeds before the scales have released their protective grip. Birds, rodents, and wind disperse the seeds. However, this method of regeneration does not compare to the abundance of saplings that sprout shortly following a forest fire. One of the best places to view the regrowth of the bishop pine forests following a large fire is at the Bay View Trail head on Limantour Road.

Other trees share the forest with the bishop pines, but usually as secondary members of the community. These include bay laurel, madrone, California buckeye, California wax myrtle, and occasionally coast live oak. Several rare and endangered species are associated with this habitat. Three species of manzanita and two varieties of ceanothus are found only in bishop pine forests.

Visions of Fire

Just mentioning the word fire is enough to spark fear and concern in most people who live in rural areas, but where does fire fit into the natural ecosystems at Point Reyes National Seashore? The answer is hidden within the rings of old trees. Fire scars in these rings have told us that fire was part of the burning cycle that occurred every 4 to 20 years in the forests of Point Reyes. Historically, these fires cleared brush, reduced fuels, and reinvigorated forest ecosystems. Some were naturally occurring while others were set by Native Americans to encourage the presence of specific wildlife and native plants.

This fire history abruptly ended some 80 years ago when fire was snuffed out at Point Reyes. As ranchers and loggers settled the land, cultural views about fire shifted. Fire was viewed as an unwanted menace that needed to be stopped. It destroyed valuable timber and threatened permanent structures. Some proudly claimed that we had finally claimed dominance over natural processes . . . others knew it was only a matter of time before the story of fire was reignited in the landscape.

That time came when the Vision Fire sparked to life on October 3, 1995. Named for its origin near the summit of Mt. Vision, the fire started from the smoldering remains of an illegal campfire. As many stared with disbelief, the fire raged out of control. Fueled by 80 years of forest litter and strong winds, it seemed capable of consuming the entire Seashore and its surrounding communities. Thirteen days later, with the help of many firefighters, helicopters, and engine equipment, the fire was brought under full control and the whole community breathed a collective sigh of relief. In the aftermath of the fire, 13,000 acres were burned and 44 structures were destroyed. The beautiful scenery of the Inverness Ridge and coastal habitats was charred and nearly devoid of life. In this seemingly ravaged landscape, a dormant beauty was waiting to come to life.

Burned area from 1995 Vision Fire, Bruce Farnsworth

If you visit the area of the 1995 burn today, what you'll find will amaze you. Bishop pine seedlings are thriving and regenerating in areas where they were historically found. Coastal scrub communities have been rejuvenated. Elk, deer, and coyotes roam the hills and northern harriers, red-tailed hawks, and songbirds fill the air. Looking back, the Vision Fire performed decades' worth of restoration over a very short span of time. It also helped bring fire management to the front of everyone's minds.

Today, fire continues to play an important role in managing natural ecosystems. By prescribing controlled burns, resource managers can use fire to reduce fuels found in forests and grasslands and mimic historic fire regimes. Controlled burns can also be used to remove invasive, nonnative species while encouraging native plant species that are the foundation of sustainable, dynamic ecosystems.

While prescribed burning for specific management goals is an extremely useful tool, it is not a silver bullet. It can not solve all ecological problems nor prevent all unplanned fire ignitions. When compared to the devastating nature of wildfires, however, it is the best alternative that exists. Prescribed burns allow managers to target critical areas to burn under ideal circumstances instead of reacting to a fire that is out of control.

No matter how hard we try to manage fire in natural areas, there will always be unplanned ignitions and fires threatening property and lives. But through prescribed burns and the systematic management of fire, the risk of large-scale fires can be minimized. What we need to decide is whether to wait for an uncontrolled fire to find us, or to choose to actively use fire to our advantage? For many, the Vision Fire has already answered that question.

Monitoring Habitat Health

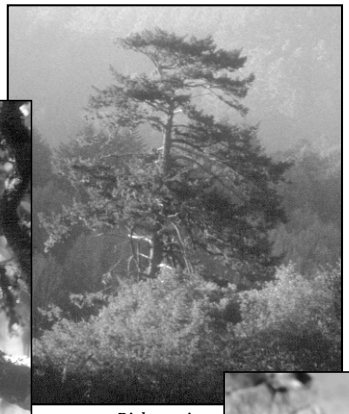
"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." **—Aldo Leopold**

When taking a walk or a drive in Point Reyes National Seashore, it's easy to see why the Seashore was established in 1962. Its beauty and wild nature are breathtaking. But is Point Reyes National Seashore ecologically healthy? Are species populations on the rise or in decline? Until a few years ago, very few questions could be answered about ecosystem health. This is changing at the Seashore with the implementation of an Inventory and Monitoring program. With the help of volunteers and partners, this program provides scientists and managers with baseline information and long-term trends within Seashore ecosystems.

Intertidal monitoring by staff and volunteers, NPS Collection

Volunteers are a critical component to many of the inventory and monitoring projects at Point Reyes. Some volunteers come from as far as an hour and half away to spend the day outside and to give something back to a place they love. Others leave a nearby classroom in Inverness or Bolinas and gain a practical, hands-on science lesson while gathering data for resource managers. Through their effort and dedication, Point Reyes receives valuable information about harbor seal and elephant seal populations, rare plants, and other species. Interns work with the northern spotted owl monitoring their numbers, their nesting productivity and behavior. Others monitor intertidal zones counting diversity and distribution of species found clinging to the rocks in areas exposed only in extremely low tides.

Northern spotted owl, NPS Collection



Bishop pine, NPS Collection

Park partners are also integral to the inventory and monitoring studies at Point Reyes. In situations where specialized experience is required or there is an overlap with other studies already being conducted, Point Reyes relies on its partners. The Seashore has developed strong partnerships with the Point Reyes Bird Observatory, the Audubon Society, the California Native Plant Society, colleges and universities, the Fish and Wildlife Service, and the Gulf of the Farallones National Marine Sanctuary. Through these partnerships, Point Reyes has gained incredible amounts of scientific information regarding mammal, amphibian, and bird populations. Through a partnership with the USGS Biological Resources Division we have documented mountain lions, black-tailed weasels, bobcats, raptors, and other notable wildlife using trail cameras at monitoring arrays.

Common murres, NPS Collection

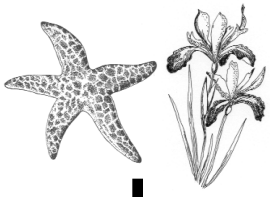
Even with volunteers and partners, there is no way to monitor all of the 900 plus species of plants, the 480 species of birds, and over 100 different species of land vertebrates. So the big question is where to focus our limited resources? The answer is where the most can be gained, where the most can be lost, and where the most attention is focused.

Elephant seal, Point Reyes, NPS Collection

At Point Reyes, inventory and monitoring efforts are concentrated in four main areas. We monitor federally threatened and endangered species like the northern spotted owls. These species are closely monitored and actively studied to protect the Point Reyes population from disturbance and decline. We also pay close attention to keystone species, such as Bishop pines and wood rats, on which total ecosystem health is hinged. Because a disruption in a keystone species can often be felt throughout an entire ecosystem, it is crucial that we understand their population dynamics. Sensitive species, like the common murres, are the third type of species that is monitored carefully. They are often the most vulnerable to changes in an ecosystem and therefore are good indicators of larger problems in the environment. Lastly, heroic species, such as the tule elk and elephant seals, are monitored. Tule elk and elephant seals capture our hearts and our minds and focus our attention on their survival for the freedom and wildness that they embody.

By focusing our efforts and working with volunteers and partners, there is more scientific work being done today at Point Reyes than ever before. We are gaining a strong base of scientific knowledge to guide management decisions within the Seashore. But there is still more to do than there are staff, volunteers, and partners. So what's the solution? It could very well be you, and some of your time. Your commitment to Point Reyes National Seashore can ensure that Point Reyes will not only remain beautiful, but healthy and full of diversity for years to come.

What Flora and Fauna Can We Expect to See on Our Field Trip?



Students will assume the roles of botanists and biologists while gaining familiarity with field guides and other research sources. All students will identify and research common wildlife and plant species found at Point Reyes National Seashore.

Time required: 2 hours
Location: classroom
Suggested group size: entire class

Subject(s): art, science, English
Concept(s) covered: natural history, ecological principles

Written by: Steve Anastasia and Beth Brindle, National Park Service
Last updated: 09/19/00

Student Outcomes

At the end of this activity, students will be able to:

- Prepare for the upcoming field trip.
- Effectively locate and record information gained through research.
- Identify common species found at Point Reyes National Seashore.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5b- organisms and the physical environment
- 5c- organisms can be categorized by the functions they serve in an ecosystem
- 5d- different organisms may play similar ecological roles in similar biomes
- 5e- organisms an ecosystem can support depends on resources available
- 7b- use appropriate tools/technology to perform tests, collect/display data
- 7d- communicate the steps and results from an investigation

7th grade
- 7a- use appropriate tools/technology to perform tests, collect/display data
- 7b- utilize a variety of print and electronic resources
- 7e- communicate the steps and results from an investigation

Pre-Visit Lesson Plan

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Identify questions that can be answered through scientific investigations; Use appropriate tools and techniques to gather, analyze, and interpret data.
- Content Standard C – Structure and function in living systems; Populations and ecosystems; Diversity and adaptations of organisms.
- Content Standard F – Populations, resources, and environments.

Materials

To be provided by the teacher:

- Research materials such as field guides, relevant books, access to the Internet

To be photocopied from this guide:

- **Animal Species**, and **Plant Species** Activity Sheets (one per species)
- Species lists for student research

Vocabulary

annual, biologist, botanist, bud arrangement, coastal scrub, coniferous, deciduous, decomposer, endangered, exotic, fauna, first order consumer, flora, habitat, perennial, producer, mixed woodland, native, riparian, scat, second order consumer, scavenger, shrub, sign, third order consumer, threatened

Procedures

1. Select one of the following locations to visit during your field trip to Point Reyes:
   - ❑ **Bear Valley Trail** = Douglas fir forest and riparian
   - ❑ **Bayview Trail to Muddy Hollow** = bishop pine forest, coastal scrub, and riparian
   - ❑ **Coast Trail** = coastal scrub and riparian (possibly sandy beach)
   - ❑ **Limantour Beach** (from big parking lot) = coastal scrub, estuary, and sandy beach

2. **Introduction**
   Have a discussion to learn about plants and animals.
   A. **Who studies plants and animals?**
      Botanists and biologists.
   B. **What are they trying to learn about?**
      Populations, their role in the ecosystem interrelationships with other species, behavior, distribution, how we affect the species.
   C. **Why do they want to know all these things?**
      The more that a species and its role in the ecosystem is understood, the more effectively it can be managed.

D. Why would a wild animal or plant need to be managed?

1) Humans are part of the ecosystem but have the power to significantly alter ecosystems.
2) Often in the past we have altered the ecosystems we live in only to find out that our actions have harmed wildlife and plant species.
3) By learning about plant and animal species we can try to prevent damage to ecosystems in the future and help to repair damage done in the past.
4) Some examples:

Salmon and dams
Peregrine falcons and DDT
Northern spotted owls and old growth forest loss
Sandhill cranes and loss of wetlands due to development

3. Activity

Students assume the role of botanists and biologists and research specific plants and animals found in a particular habitat. *(Research is one step in understanding an ecosystem)*

A. Instructions:

1) Students will break into teams (2–5 students). The teams will consist of both botanists and biologists.
2) Using the species list for a particular habitat, give each student team a list of the plants and animal species that they will independently research. *(See appropriate Teacher Information "Species List".)*
3) Student teams will need a copy of the plant and animal activity sheets for each of the plant and animals they research.
4) Students can use field guides, other books, or the Internet to complete their research sheets (this can be done in class or as homework). See Resources at end of guide.

B. Some explanation may be needed to explain the use of field guides, indexes, etc.

4. Discussion

A. Have each group pick one of the researched plants or animals and present its findings to the class. This includes any important identifying characteristics, its role in the ecosystem (producer, consumer, decomposer, or scavenger) and why they chose this animal or plant to present.

B. Wrap-up

1) Review what has been learned.
2) How to use a field guide.
3) Plants and animals found in a specific habitat.
4) Tie lesson to on-site visit "What Flora and Fauna Can We Observe at Point Reyes?"
5) Research is one part of understanding an ecosystem but is not the only one. When we visit Point Reyes National Seashore, we will be performing field observations to further gain understanding of our studied ecosystem.

C. To aid in field observations, compile completed animal and plant identification sheets into "Guide Book" for use at Point Reyes.

Extension Activities

1. Research one of the following topics including what restoration efforts have taken place or are currently being implemented:
   A. Salmon and dams
   B. American peregrine falcons and DDT
   C. Northern spotted owl or marbled murrelet and old growth forest loss
   D. Greater sandhill crane and loss of wetland habitat due to development
   E. Common murres and the Apex oil spill (offshore San Francisco)
   F. Nonnative species removal in the San Francisco Bay
   G. California condor reintroduction efforts

   (A great source of background information on the above topics is found at ***www.fws.gov***.)
2. Research how someone becomes a botanist or a biologist and what each does.
3. Invite a botanist and/or biologist to your classroom to discuss their job.

Name _____ **Date** _____

Activity Sheet

Animal Species

(Amphibians, Reptiles, Fish, Mammals, and Birds)

Common name:

_____

Scientific name:

_____

Classification

Is this animal a (check one)

- ❑ Mammal
- ❑ Reptile
- ❑ Amphibian
- ❑ Fish
- ❑ Bird

Draw or include a picture of your animal.

Description

Size: _____ Weight: _____

Color: _____ Other important information: _____

_____

Range, Habitat and Niche

Range: _____

_____

_____

Habitat preference: _____

_____

_____

Circle below which niche your species fills in the food web.

producer	1st-order consumer	2nd-order consumer
3rd-order consumer	decomposer	scavenger

Activity Sheet

Name _____ **Date** _____

Animal Species

Life Cycle

At what age does this animal reach maturity? _____

Describe this animal's breeding behavior: _____

_____

_____

Food Chains

Who is (are) this animal's prey? _____ predator(s)? _____

How does it prevent itself from becoming prey? _____

_____

Sign

Sometimes you can identify animals from their "sign" without ever seeing the animal. What is this animal's sign? _____

_____

Draw two signs of this animal below.

Type of sign: _____ Type of sign: _____

Humans in Ecology

Is this animal: (circle one)

endangered	threatened	sensitive	abundant

What are the causes of the designation above? _____

_____

_____

Are humans currently helping this species? How? _____

_____

_____

Name _____ **Date** _____

Activity Sheet

Plant Species

Common name: _____

Scientific name: _____

Draw a picture of your plant species.	Draw a picture of this species' leaf or needles.

Classification

Identify the type of plant: ❑ tree ❑ shrub ❑ flowerering plant

Is it deciduous or coniferous? _____

Is it annual or perennial? _____

What is the bud and leaf attachment?

❑ Alternate ❑ Opposite ❑ Whorled ❑ Fascicled

Why are these characteristics important? _____

_____

_____

Ecological Niche

List the conditions in which this species will thrive: _____

_____

_____

_____

Activity Sheet

Name _____ **Date** _____

Plant Species

Ecological Niche (continued)

What factors limit this species? _____

_____

_____

Does this species have any unique survival strategies? What are they?

_____

_____

_____

List an unusual or interesting fact about this plant.

_____

_____

_____

What other species rely on or are impacted by the presence of this plant?

_____

_____

Circle which niche your species fills in the food web. Circle one.

producer	1st-order consumer	2nd-order consumer
3rd order-consumer	decomposer	scavenger

Humans in Ecology

This plant is classified as: (mark one)

❑ endangered ❑ threatened ❑ sensitive ❑ abundant

Is it native or exotic to Point Reyes? If it is exotic, how and why was it introduced at Point Reyes? _____

_____

_____

Has this plant been used for human consumption? If so, how?

_____

_____

Identifying Plants and Animals in the Field

When you don't know what kind of plant or animal you are observing, try to remember important characterisitics that will help identify the species in a field guide.

Bird:

Where is it located? What habitat are you in?
What shape is the beak?
What colors are the feathers?
What is it doing?
What is its flight pattern?

Mammal:

Where is it located? What habitat are you in?
What color(s) is the fur?
What is it doing?
How big is it?
Does it have any unique features? (antlers, big ears, short tail . . .)

Plant:

Where is it located? What habitat are you in?
What shape are the leaves?
What is the leaf arrangement?
How big is it?
Does it have any unique features? (stem shape, bark, color, flowers, cones, fruits . . .)

Amphibian:

Where is it located? What habitat are you in?
Is it a frog, toad, or salamander?
What color(s) is it?
What shape is its head and body?

Reptile:

Where is it located? What habitat are you in?
Is it a lizard, snake, skink, or turtle?
What color(s) is it?
What shape is its head and body?

Invertebrate:

Where is it located? What habitat are you in?
Is it an insect, shellfish, starfish, worm, or sponge?

Coastal Scrub Species List

Teacher Information

Native plants

- ❑ Cow parsnip
- ❑ Bush lupine
- ❑ Coyote bush
- ❑ Ceanothus
- ❑ California poppy
- ❑ Indian paintbrush
- ❑ Douglas iris
- ❑ Poison oak
- ❑ Huckleberry
- ❑ Bush monkey flower

Native amphibians/reptiles

- ❑ Red-sided garter snake
- ❑ Banana slug
- ❑ Pacific tree frog

Birds

- ❑ Anna's hummingbird
- ❑ California quail
- ❑ Turkey vulture
- ❑ Red-tailed hawk
- ❑ American kestrel
- ❑ Northern harrier

Mammals

- ❑ Coyote
- ❑ Spotted skunk
- ❑ Black-tailed deer (mule deer)
- ❑ Tule elk
- ❑ Mountain lion
- ❑ Pocket gopher
- ❑ Bush rabbit
- ❑ Gray fox
- ❑ Bobcat
- ❑ Deer mouse
- ❑ Raccoon

Native Plants

- ❑ Coast live oak
- ❑ California coffeeberry
- ❑ Red elderberry
- ❑ California bay
- ❑ Douglas fir
- ❑ Thimbleberry
- ❑ Poison oak
- ❑ Old-man's beard
- ❑ Hazelnut
- ❑ Tan oak
- ❑ Ceanothus
- ❑ Bishop pine
- ❑ California hazelnut
- ❑ Bay laurel
- ❑ Madrone
- ❑ California buckeye
- ❑ Manzanita
- ❑ Huckleberry

Native amphibians/reptiles

- ❑ California newt
- ❑ Banana slug
- ❑ Terrestrial garter snake

Birds

- ❑ California quail
- ❑ Acorn woodpecker
- ❑ Turkey vulture
- ❑ Steller's jay

Mammals

- ❑ Wood rat
- ❑ Black-tailed deer
- ❑ Mountain lion
- ❑ Striped skunk
- ❑ Western gray squirrel

Riparian Species List

Native Plants

- ❑ Miner's lettuce
- ❑ Horsetail
- ❑ Stinging nettle
- ❑ Yellow willow
- ❑ Red alder
- ❑ Blackberry

Native amphibians/reptiles

- ❑ California red-legged frog
- ❑ Rough-skinned newt
- ❑ Aquatic garter snake
- ❑ Pacific tree frog
- ❑ Salamander

Mammals

- ❑ Raccoon
- ❑ Black-tailed deer

Fish

- ❑ Coho salmon
- ❑ Steelhead trout

Invertebrates

- ❑ Banana slug

Birds

- ❑ Olive-sided flycatcher
- ❑ Wilson's warbler
- ❑ Red-shouldered hawk
- ❑ Northern harrier
- ❑ Great-horned owl
- ❑ Northern spotted owl

Estuary Community Species List

Birds

- ❑ Snowy egret
- ❑ Great blue heron
- ❑ Mallard
- ❑ Green-winged teal
- ❑ Northern shoveler
- ❑ Marbled godwit
- ❑ Willet
- ❑ Osprey
- ❑ Black brant
- ❑ Pied-billed or Western Grebe
- ❑ Surf or White-winged Scoter

Native Plants

- ❑ Eelgrass
- ❑ Cordgrass
- ❑ Pickleweed
- ❑ Salt grass

Marine Invertebrates

- ❑ Washington clam
- ❑ White sand clam
- ❑ Shrimp
- ❑ Fat innkeeper
- ❑ Geoduck
- ❑ Nudibranch
- ❑ Hydroid
- ❑ Sponge
- ❑ Tunicate
- ❑ Feather-duster worm
- ❑ Red scale worm
- ❑ Pea crab
- ❑ Oregon shore crab
- ❑ Gaper clam
- ❑ Channeled basket whelk
- ❑ Tall-spired horn snail

Fish

- ❑ Goby fish
- ❑ Bat ray
- ❑ Leopard shark
- ❑ Rubberlips
- ❑ Topsmelt
- ❑ Pacific herring
- ❑ Coho salmon
- ❑ Flounder

Mammals

- ❑ Harbor seal
- ❑ Raccoon

Sandy Beach/Dune Community Species List

Birds

- ❑ Snowy plover
- ❑ Black-bellied plover
- ❑ Marbled godwit
- ❑ Willet
- ❑ Heermann's gull
- ❑ Ring-billed gull
- ❑ Western gull
- ❑ Brown pelican
- ❑ Sanderling
- ❑ Turkey vulture
- ❑ Raven

Marine Invertebrates

- ❑ "Beach hopper" amphipod
- ❑ Sand crab (mole crab)
- ❑ *Velella velella* (by the wind sailor)
- ❑ Sand dollar
- ❑ Shore crab

Plants

- ❑ American dune grass
- ❑ Sand verbena
- ❑ Saltbush
- ❑ Douglas bluegrass
- ❑ Beach strawberry
- ❑ Dune lupine
- ❑ Beach morning glory

Mammals

- ❑ Striped Skunk
- ❑ Gray Fox
- ❑ Raccoon

Tide Pool Community Species List

Marine Invertebrates

- ❑ Anemone
- ❑ Nudibranch
- ❑ Chiton
- ❑ Red abalone
- ❑ Limpet
- ❑ Sea star
- ❑ Hermit crab
- ❑ Barnacle
- ❑ Goose barnacle

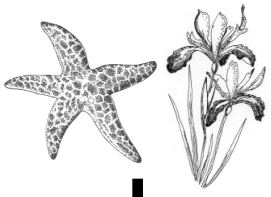
Fish

- ❑ Opaleye

Marine Plants

- ❑ Turkish towel (red algae)
- ❑ Sea lettuce (green algae)
- ❑ Eelgrass
- ❑ Surfgrass
- ❑ Sea palm

How Can We Prepare for Our Visit to Point Reyes National Seashore?



Students will prepare for the upcoming field trip by constructing field journals and reviewing personal field trip expectations.

Time required: 1 hour
Location: classroom
Suggested group size: entire class

Subject(s): science, math, writing
Concept(s) covered: field observations and data collection

Written by: Christie Denzel Anastasia, National Park Service
Last updated: 10/09/00

Student Outcomes:

At the end of this activity, students will be able to:

- Utilize field journals while observing habitats at Point Reyes National Seashore.

California Science Standards Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade 7b- use appropriate tools/technology to perform tests, collect/display data
7th grade 7a- use appropriate tools/technology to perform tests, collect/display data
8th grade 9a- plan and conduct a scientific investigation to test a hypothesis

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Use appropriate tools and techniques to gather, analyze, and interpret data; Understanding about scientific inquiry.
- Content Standard G - Science as a human endeavor

Materials

To be photocopied from this guide:

- Field Journal Sheets for each student, teacher, and chaperone (located in first onsite lesson plan)
- Vocabulary sheets (located in Attachments of Teachers Preparation)

Pre-Visit Lesson Plan

Procedures

1. **Preview Field Trip Logistics**

   See the on-site journal activity instructions for **What Flora and Fauna can we observe at Point Reyes?**

2. **Have the students construct their Field Journals**

   A. See the attached sheet for "Tips for Constructing Field Journals".
   B. Hand out photocopies of the Journal Sheets and the vocabulary list. If you are not visiting the beach habitats, then omit the field journal sheets that have only starfish in the upper corner and use only the land habitat vocabulary list (with the Douglas Iris in the corner).
   C. Have students assemble their field journals.

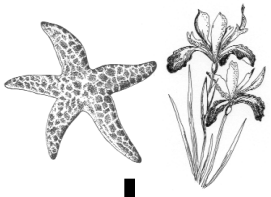
3. **Review field activities by having students turn to appropriate page in their journal as you review expectations:**

   - **Things to Remember While on the Habitats Field Trip**
     Students will complete this sheet at the end of the next lesson, "Safety and Stewardship Challenge".
   - **Three Things to Watch Out For . . . and How to Avoid Them!**
     Review this information with students for a safe field trip.
   - **Bear Valley Visitor Center Activity Sheets**
     Students will answer questions on these sheets while inside the Bear Valley Visitor Center. Some questions require students to label their answers on a map. The "Annual Precipitation" sheet provides information to answer one of the questions.
   - **Field Observation Sheets**
     Once students are given a place to sit on the trail, each of the following sheets will need to be filled out to the best of a student's ability:
   - **Habitat Information**
     Students use their powers of observation to complete the information requested.
   - **Habitat Key**
     Student information sheet that will provide answers to some of the questions on the "Habitat Information" journal sheet.
   - **Using Leaves to Identify Plants/ Layers of Forest Life**
     Student Information sheet that will provide answers to some of the questions on "Plant Observations" journal sheet.
   - **Identifying Plants and Animals in the Field**
     Student Information sheet that will provide answers to some of the questions on "Wildlife Observations" journal sheet.
   - **Plant Observations/ Wildlife Observations/ Seashore Observations**
     Students use their powers of observation to complete the information requested.

4. **Additional Sheets**
   - **Species List by Habitat Type**
     These student information sheets list some of the most common or likely to be seen species in the Seashore.
   - **Vocabulary Sheets**
     Include vocabulary sheets from the Attachments section of Teacher Preparation in students' journals. If students are unsure of a word listed their field journals, these sheets will provide a definition.
5. **Review what students should bring on the field trip**
   (see the chart in the Teacher Preparation unit)

Extension ideas

1. Have students assume the role of aliens coming to study humans and their pets. What type of field journal would they need? What key characteristics would they use? How would they observe without altering the behavior of their subjects or scaring them away?
2. Research other laws written to protect mammals, plants, and amphibians in Point Reyes National Seashore, California, and the United States. Visit the environmental law web site at www.habitat-restoration.com/laws.htm
3. What happens if a protected animal leaves the area affording protection?
4. Research the role of marine biology and other types of studies conducted. What is done with information collected in the field, and how does it help the organism being studied?



Tips for Creating Field Journals

Materials

- ❏ Field Journal Sheets for each student, teacher, and chaperone
- ❏ One package blank paper and one package lined paper
- ❏ colored paper, card stock, or cardboard for journal covers
- ❏ magic markers or colored pencils for decorating covers
- ❏ 3-hole punch
- ❏ string, binding tape, or twigs and rubber bands for binding
- ❏ pencil on a string for each student
- ❏ two plastic pencil sharpeners and extra pencils for field trip
- ❏ one box of large ziplock bags to rainproof journals

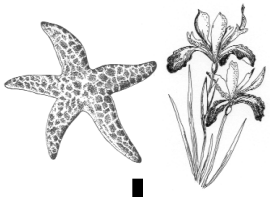
Procedures

1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or twigs bound by rubber bands threaded through holes. If they do not bind their journals, it is essential that students use a clipboard on the field trip.
5. Once journals are bound, have them decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have students use magic markers to write their names on the front covers of their journals.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension ideas

1. Create a journal that is used throughout the year.
2. Share student journals with parents at open houses and/or to educate others.
3. Students may choose to use their journals to create a class newsletter, resource newspaper, or a class website.

Safety and Stewardship Challenge



Students will learn methods for observing flora and fauna and understand proper behaviors in a National Park. This will be accomplished by simulating a group "game show" and completing the first page of their field journals.

Time required: half an hour or more (depending on predetermined limits)
Location: classroom
Suggested group size: any

Subject(s): science
Concept(s) covered: low impact use of natural areas, visitor behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service
Last updated: 09/21/00

Student Outcomes

At the end of this activity, students will be able to:

- List three safety precautions for the upcoming field trip.
- List three proper behaviors for observing wildlife.
- Understand concepts of the National Park System and stewardship.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard F–Personal Health: Injury Prevention; Populations, resources, and environment

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team has the first answer)

To be photocopied from this guide:

- "Safety and Stewardship Challenge Questions" (one set)

Vocabulary

stewardship

Pre-Visit Lesson Plan

Procedures

1. Divide class into teams

Option A: If the class can work in large teams, divide the class in half. Each team will need a spokesperson and team name. Answers will come from the entire team and the spokesperson can change throughout the game.

Option B: If the class gets too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Students randomly choose a number from hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.

2. Draw challenge grid and scorecard on blackboard

There are four categories with questions of varying value. As a finale, there is a final challenge question. Draw this grid on the chalkboard:

<table>
<tr><td colspan="4">Safety and Stewardship Challenge</td></tr>
<tr><td>Category #1
Take Care of Yourself</td><td>Category #2
Minimize Your Impact</td><td>Category #3
Habitat Etiquette</td><td>Category #4
The National Park Service</td></tr>
<tr><td>1 point</td><td>1 point</td><td>1 point</td><td>1 point</td></tr>
<tr><td>2 points</td><td rowspan="2">2 points</td><td>2 points</td><td rowspan="2">2 points</td></tr>
<tr><td>3 points</td><td>3 points</td></tr>
<tr><td rowspan="2">4 points</td><td rowspan="2">3 points</td><td>4 points</td><td rowspan="2">3 points</td></tr>
<tr><td>5 points</td></tr>
<tr><td colspan="4">Final Challenge</td></tr>
</table>

3. Choose challenge hosts

Option A: Teacher is responsible for asking all of the questions.

Option B: Four students will become "Challenge Hosts". Each student receives questions for a specific category and will ask appropriate questions according to point value.

4. **Rules of the game**
   - A coin flip will determine which team goes first.
   - The game will end when a predetermined time runs out or when all questions have been answered.
   - Team will decide which category and value of question will be asked.
   - Spokespersons or individuals will poise themselves on either side of the desk bell with one hand behind their back.
   - After the question is asked, the first team to have an answer will ring the bell and respond. If they are correct, the team receives the full point value.
   - If they are incorrect, the other team gets a chance. If they also get it wrong, the first team can try again for one less point.
   - When brainstorming answers, students should whisper (or the other team may hear their answer).
   - When all of the categories are complete (or 5 minutes before a predetermined "game over" time), class will go into "Final Challenge". Each team decides on the amount to wager, listens to the question and writes down the answer on a sheet of paper. Each team reveals their answer.
   - At the end of the game, the team with the most points "wins", but everyone wins if their visit to Point Reyes National Seashore is safe for themselves and the resources.
5. **Complete first page of field journal**

   Using the information gained in this "game show", have students list at least three items under each category on the first page of their journal ("Things to Remember While on the Habitat Field Trip"). Use the "Safety Issues: Habitat Unit" at the end of this lesson as a guide.

Safety and Stewardship Challenge Questions

Teacher Master

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because . . .

A . . . you will not be able to speak well with a dry throat.

B **. . . not drinking enough water can give you a headache and cause you to make bad decisions.**

C . . . a heavy water bottle will slow you down as you are walking.

D All of the above.

2 points

If the sun feels warm, you should . . .

A . . . try to get a tan.

B **. . . use sunglasses, sunscreen, and/or a hat.**

C . . . take off your shoes and walk barefoot.

D All of the above.

3 points

Cliff edges in Point Reyes National Seashore are . . .

A . . . made of granite and are safe as long as you have one foot flat on the ground at all times.

B **. . . sandy, loose, and slippery; be careful at all times.**

C . . . safe if you have good balance.

D . . . the best places for a good view.

4 points

The best way to dress for a field trip:

A comfortable closed-toed shoes.

B a t-shirt and a heavy, waterproof jacket.

C "like an onion", many thin layers with a waterproof one on the outside.

D **A and C.**

Teacher Master

Safety and Stewardship Challenge Questions

CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because . . .

A . . . you are more likely to pick up a tick in grassy areas.

B . . . you can damage plants.

C . . . when you travel off-trail you are speeding up erosion.

D **All of the above.**

2 points

It's okay to take home just one rock from Point Reyes National Seashore.

A Sure, it's just one, but let your teacher know.

B No, every rock is home to many bugs and plants.

C No, with 2.5 million visitors, the Seashore would be rock-less if every visitor collected just one.

D **B and C.**

3 points

Trash is . . .

A . . . okay to hide behind bushes in a National Park because it will eventually break down.

B . . . not a good source of food for hungry animals.

C **. . . not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's your trash, or trash that someone else has left behind.**

D . . . only the responsibility of the maintenance staff, wherever it is.

Safety and Stewardship Challenge Questions

Teacher Master

CATEGORY #3: Habitat Etiquette

1 point

To avoid getting exposed to poison oak, stinging nettle, and ticks in the park, you should . . .

A . . . know what stinging nettle and poison oak look like before touching plants.

B . . . stay on the trails.

C . . . wear light colored clothes and check them regularly for ticks.

D **All of the above.**

2 points

If you see a rattlesnake or mountain lion, you should . . .

A . . . pet it.

B . . . scream and run to the nearest tree.

C . . . **slowly back away and avoid any startling behaviors.**

D . . . get as close as you want.

3 points

The best way to observe wildlife is to:

A have patience.

B stay in one place for a while being as quiet as possible.

C pay attention.

D **all of the above.**

4 points

Feeding wildlife will . . .

A . . . be okay, because it is legal.

B . . . put you in danger of a bite or an attack.

C . . . accustom them to humans and possibly create behaviors harmful to the animal's survival.

D **B & C above.**

5 points

If you come across wildlife appearing sick or injured, you should:

A . . . try to capture the animal and seek medical attention.

B . . . **report the location, species, and your observations to someone who is responsible for its management (Park Rangers in National Parks, Humane Society in urban areas).**

C . . . leave it alone.

D . . . take it to the emergency room.

Teacher Master

Safety and Stewardship Challenge Questions

CATEGORY #4: The National Park Service

1 point

Which of the following is not in the National Park Service?

A Grand Canyon National Park, AZ.

B Keweenaw National Historical Park, MI.

C **Monterey Bay Aquarium, CA.**

D Golden Gate National Recreation Area, CA.

E Yosemite National Park, CA.

2 points

I should treat Point Reyes National Seashore with respect because . . .

A . . . it belongs to everyone in the entire United States.

B . . . it preserves a part of the ecosystem you live in and depend on.

C . . . it's one of the few places natural processes can happen with little intervention from human society.

D **All of the above.**

3 points

Which of the following is the mission of the National Park Service?

A preserve natural and cultural resources.

B provide for the enjoyment, education, and inspiration of this generation.

C to care for special places saved by the American people so that all may experience our heritage.

D cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.

E **All of the above.**

Teacher Master

Bonus for one additional point:

Is the mission of the National Park Service a law? (Yes) No

Yes. The 1916 Organic Act mandates the National Park Service to preserve and protect the natural and cultural heritage of the United States for the enjoyment of its citizens, leaving them unimpaired for the enjoyment of future generations.

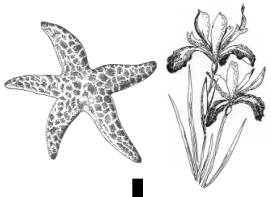
FINAL CHALLENGE

This question is worth the amount that each team agrees to wager.

What does stewardship mean?

Teacher is the final judge on this answer.

Safety Issues: Habitat Unit



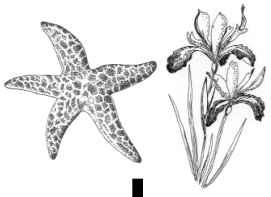
Personal Safety

- Watch where you are walking; the ground may be rocky and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays; use sunscreen and/or a hat.
- Stay on paths and in picnic areas. Grassy areas may have ticks that are known to transmit Lymes' disease.
- Be aware of personal allergies or conditions that may cause concern on the trail.
- Follow all directions and observe posted signs.
- Watch out for poison oak and stinging nettle.

Remember, you are in a part of the National Park System.

- Point Reyes National Seashore is a natural area set aside to protect living and nonliving components of an ecosystem. Treat everything with respect.
- Allow plants and rocks and everything to continue their existence as part of an ecosystem by leaving things as they are found.
- Stay on established trails.
- Pack out trash or use garbage cans.
- Enjoy your visit and know this is your National Seashore!
- Think about what makes Point Reyes National Seashore worth preserving and how you can help.

How Do I Use Binoculars?



Students prepare for upcoming field trip by becoming familiar with binocular structure and use. Being able to clearly see parts of each habitat will greatly increase the success of your field trip.

Time required: 30 minutes
Location: in class and/or sections at Bear Valley Visitor Center
Suggested group size: entire class

Subject(s): physics
Concept(s) covered: binocular structure and use

Written by: Christie Denzel Anastasia, National Park Service
Last updated: 09/31/00

Student Outcomes

At the end of this activity, students will be able to:

- Understand the structure of binoculars.
- Practice focusing on moving images with binoculars.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade 7b- use appropriate tools/technology to perform tests, collect/display data

7th grade 6b- to see an object, light emitted/scattered must enter eyes
6d- simple lenses used in optics
7a- use appropriate tools/technology to perform tests, collect/display data

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Abilities necessary to do scientific inquiry: Use appropriate tools and techniques to gather, analyze, and interpret data.

Materials

To be provided by the teacher:

- Perhaps one pair of binoculars

Procedures

Note: This lesson can be done in various stages depending on whether or not students have access to binoculars in class.

If students can ***bring in a pair*** of binoculars to use in class:

This entire lesson can be conducted in class.

If students can ***share a pair*** of binoculars to use in class:

Procedure 1 and 2 can be taught to entire class. Student teams can experiment with binoculars in 10-minute intervals throughout day.

If students ***do not have access*** to binoculars:

Procedures 1 and 2 can be conducted in class, Procedure 3 at Bear Valley Visitor Center when students receive individual binoculars from the Habitat Kit.

1. **How do binoculars work?**
(There are numerous websites on binocular structure for more information.)

Brief summary:

In Theory: Before prisms were available, lens barrels had to be very long to increase the distance between eyepiece lens and objective lens to achieve magnification. These are the traditional "pirate scopes". With the introduction of prisms, the light can be bent and barrels made shorter. Binocular vision allows two images to become one for depth perception. Monoculars are like binoculars, but made for one eye and have no depth perception.

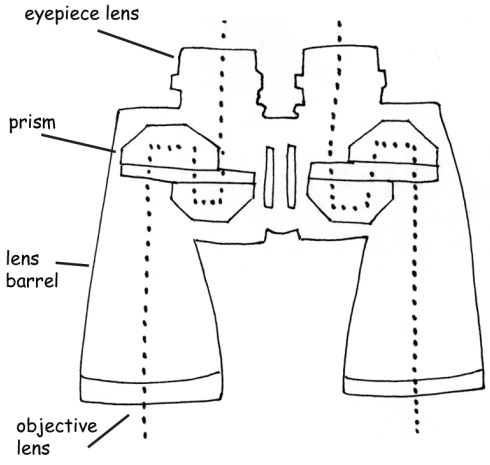
In Structure: There are four main components of binoculars. Power is a function of these components. A 6 x 30 binocular has 6x magnification and a 30-millimeter lens. A larger lens lets in more light.

Eyepiece Lens: there are several convex lenses here for magnification. This is the lens closest to your eyes.

Prism: Bends light rays and returns reverse image to normal.

Lens Barrel: Keeps distance between eyepiece lens and objective lens. Keeps out side lighting and dirt.

Objective lens: Gathers light in a convex lens. This is the lens that has a millimeter measurement (i.e., 6 x 30).



2. **How do I get binoculars to work specifically for me?**

Taking care of binoculars:

- Always keep them attached around your neck so they aren't accidentally dropped.
- While you are focusing binoculars, stand still. It would be easy to fall while focusing and walking.
- Clean binoculars properly.

If you wear eyeglasses:

- Keep your eyeglasses on.
- There is usually an "eye cup" rubber piece that folds back where your eyeglasses meet the eyepiece lens.

Things you adjust once:

- Barrel distance: The two barrels can be moved closer or further apart depending on the distance between your eyes.
- Focus right eyepiece: There is a knob on the right eyepiece that corrects for visual differences between your two eyes. If you are seeing more than one image, adjust the right eyepiece until there is one image.

Things you need to adjust with each observation:

- Center focus: Adjust the center focus with each observation to bring image into view.

Focusing on an image:

- Adjust barrel distance and right eyepiece.
- Locate the image with your eyes. Are there any landmarks or reference points next to the image? These references may help you find the image again with binoculars near your eyes.
- Focus your eyes on the image. Without looking down, place the binoculars directly in front of your eyes. The rubber cup surrounding the eyepiece lens should rest against your eyebrow (unless you are wearing eyeglasses).
- Focus image into view with center focus.
- Keep elbows tucked in close to body and both hands on binoculars to avoid a shaky image.

3. **Practice using binoculars.**

Focus on stationary object.

- Pick an object that doesn't move. Choose one somewhat near and one somewhat far. Use center focus.

Focus on moving objects in class.

- Right/left: Have a student walk slowly across class while students keep in view. Speed up student walker to add a challenge.
- Away/toward: Choose a student to move toward and away from binoculars. Discuss range that binoculars will work. At some point, the object is too close to focus.

Focus on multiple moving objects at school.

- Attend a sporting event or practice at a lunch session in cafeteria.
- Place a wildlife poster on a piece of cardboard and stick. Have a student move around classroom with poster board: slow, fast, up, down, toward, away.

Focus on wildlife.

- Bring class outside in an area where they are likely to view moving wildlife such as birds.